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**Overcrowding in the Brigade Rear Area
and
Its Effects on Combat Power Generation**

**A Monograph
by**

**Major Michael E. Ivy
Ordnance Corps**

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**School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas**

First Term AY 89/90

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90-3176

90 08 20 052

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited		
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies, USAC&GSC		6b. OFFICE SYMBOL (If applicable) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION		
8a. ADDRESS (City, State, and ZIP Code) Fort Leavenworth, Kansas 66027-6900			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING / SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.
			WORK UNIT ACCESSION NO.		
11. TITLE (Include Security Classification) Overcrowding in the Brigade Rear Area and Its Effects on Combat Power Generation (U)					
12. PERSONAL AUTHOR(S) MAJ Michael E. Ivy, USA					
13a. TYPE OF REPORT Monograph		13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 90/01/03		15. PAGE COUNT 53
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	terrain management, combat power generation forces, brigade rear area, operational planning readiness, overcrowding, Brigade Rear Area, S. C. P. S.		
19. ABSTRACT (Continue on reverse if necessary and identify by block number) This monograph examines rear area terrain management of armored and mechanized brigades. The study focuses on overcrowding, which can result from poor terrain management, as it relates to the brigade's warfighting capability. The specific research question is: How is a brigade's ability to generate combat power affected by overcrowding in the brigade rear area? The monograph first establishes which units may locate in the brigade rear area, how they contribute to combat power generation, and their siting considerations. Next, the conditions that may cause overcrowding are described. The relationship between overcrowding and combat power generation is then established using as criteria Colonel Huba Wass de Czege's Combat Power Model. Three alternatives are analyzed for relieving overcrowded conditions. <i>See index</i> (continued on other side of form)					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL MAJ Michael E. Ivy			22b. TELEPHONE (Include Area Code) (913) 684-2138	22c. OFFICE SYMBOL ATZL-SWV	

Item 19 cont.

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The monograph includes several noteworthy findings:

- There are at least as many combat and combat support units in the brigade rear area as combat service support units.
- The most likely cause of overcrowding is operational plans.
- Divisions and corps can contribute significantly to overcrowding.
- Overcrowding degrades the ability of brigades, and thus divisions and corps, to generate combat power.
- Relieving overcrowding is possible with existing resources.


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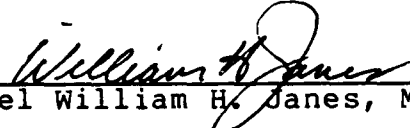
Major Michael E. Ivy

Title of Monograph: Overcrowding in the Brigade Rear Area
and Its Effects on Combat Power
Generation

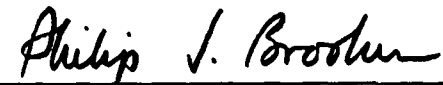
Approved by:



Lieutenant Colonel James L. Moody, MS Monograph Director



Colonel William H. Jones, MA, MMAS Director, School of
Advanced Military
Studies



Philip J. Brookes, Ph.D. Director, Graduate
Degree Program

Accepted this 26th day of March 1990

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DTIC TAB
Unannounced
Justification
By
Distribution/
Availability Code
Avail and/or
Special
Dist
A-1

ABSTRACT

Overcrowding in the Brigade Rear Area and Its Effects on Combat Power Generation, by Major Michael E. Ivy, USA, 48 pages.

This monograph examines rear area terrain management of armored and mechanized brigades. The study focuses on overcrowding, which can result from poor terrain management, as it relates to the brigade's war-fighting capability. The specific research question is: How is a brigade's ability to generate combat power affected by overcrowding in the brigade rear area?

The monograph first establishes which units may locate in the brigade rear area, how they contribute to combat power generation, and their siting considerations. Next, the conditions that may cause overcrowding are described. The relationship between overcrowding and combat power generation is then established using as criteria Colonel Huba Wass de Czege's Combat Power Model. Three alternatives are analyzed for relieving overcrowded conditions.

The study concludes with two implications for the U.S. Army. First, brigade rear area terrain management deserves attention in Field Manual 71-3, Armored and Mechanized Infantry Brigade. The manual currently offers scant coverage of terrain management, leaving unaddressed the potential causes of overcrowding and its effects on combat power generation. Second, division and corps headquarters must actively participate in brigade rear area terrain management. Divisions and corps can contribute to overcrowding to such an extent that their involvement is necessary to prevent or reduce it.

The monograph includes several noteworthy findings:

- There are at least as many combat and combat support units in the brigade rear area as combat service support units.
- The most likely cause of overcrowding is operational plans.
- Divisions and corps can contribute significantly to overcrowding.
- Overcrowding degrades the ability of brigades, and thus divisions and corps, to generate combat power.
- Relieving overcrowding is possible with existing resources.

TABLE OF CONTENTS

	Page
I. Introduction	1
II. Units in the Brigade Rear Area	4
Combat Power Generation	6
Siting Considerations	8
III. Conditions That May Cause Overcrowding	14
Brigade Rear Area Size and Terrain Configuration	14
Similarities of Siting Requirements	15
Operational Plans	16
IV. The Relationship Between Overcrowding in the Brigade Rear Area and Combat Power Generation	23
Firepower Effects	25
Maneuver Effects	27
Protection Effects	28
V. Relieving Overcrowded Conditions	30
Enlarging the Brigade Rear Area	31
Changing Plans	31
Relocating Brigade Rear Area Units	33
VI. Conclusion and Implications	36
Glossary	39
Endnotes	40
Bibliography	45

TABLES

	Page
Table I	Units in the Brigade Rear Area5
Table II	Contribution of Units in the Brigade Rear Area to the Generation of Combat Power7
Table III	Terrain Management Considerations9
Table IV	The Combat Power Model24

FIGURES

Figure 1	Brigade Counterattack in Sector20
Figure 2	Division Counterattack Through the Brigade Sector20
Figure 3	Division Counterattack Plans with Three Axes21

I. INTRODUCTION

Supplies were crammed into every nook and cranny of the Normandy lodgement area by the end of July 1944.

The Allies' slow tactical advance resulted in a beach-head only one tenth of the expected size, negating space allocation plans for logistical units. The crowding and congestion degraded supply operations, jammed traffic, and exposed the sustainment base to air attack.¹

According to Martin Van Creveld, the area was "hopelessly congested, a perfect target for the Luftwaffe, had it been able to intervene."²

The problems caused by overcrowding did not abate until Operation COBRA kicked off on 25 July. Till then, uncamouflaged supplies accumulated in open fields, protected only by the Allies' complete air superiority. As it was, a mid-July "explosion and fire destroyed more than 2,000 of 50,000 tons of ammunition held in a large depot near Formigny."³ Inadequate dispersion was a major reason for the large losses.

Rear area terrain management today promises similar problems of perhaps greater magnitude. The numbers of vehicles in both combat and logistical units are considerably larger, the logistical "tail" has grown, and the rear area is a more likely target for air and ground attack. If rear operations are to preserve the commander's freedom of action and continuity of operations, as AirLand Battle doctrine suggests,⁴ then good terrain

management is critical.

The purpose of this monograph is to examine rear area terrain management of armored and mechanized brigades. The study focuses on overcrowding, which can result from poor terrain management, as it relates to the brigade's warfighting capability. The research question is: How is a brigade's ability to generate combat power affected by overcrowding in the brigade rear area?

Rear area terrain management is "something which we [the U.S. Army] traditionally have not done well."⁵ One reason for this is doctrinal inattention. Field Manual 90-14, Rear Battle, discusses rear operations only at those levels where a rear area operations center (RAOC) is found. This manual includes only three pages on division and corps terrain management.⁶ Field Manual 71-100, Division Operations, and Field Manual 100-15, Corps Operations, include brief discussions of rear area terrain management for their respective echelons.⁷ Field Manual 71-3, Armored and Mechanized Infantry Brigade, is the only doctrinal source for terrain management in the brigade rear area. Its coverage of the subject is less specific than Field Manuals 71-100 and 100-15.⁸

A second reason for poor rear area terrain management is common misunderstanding of two important definitions - the brigade rear area and the brigade support area (BSA).⁹ The brigade rear area is the area

extending rearward from the battalion rear boundaries to the brigade rear boundary and between the brigade's lateral boundaries.¹⁰ There are a variety of combat, combat support (CS), and combat service support units in the brigade rear area. The brigade S3 positions units in the brigade rear area, although Field Manual 71-3 is vague in this regard.¹¹

The BSA is "a designated area in which combat service support (CSS) elements from the division support command (DISCOM) and corps support command (COSCOM) provide logistic support to a brigade."¹² The BSA includes, as a minimum, the forward support battalion (FSB). The FSB commander manages the terrain in the BSA. Terrain management in the brigade rear area is obviously more difficult if the distinctions between these two areas and the associated responsibilities is unclear.

Overcrowding, as the focus of this monograph, also merits definition. It means that the space required for units to deploy in a given area exceeds the available usable space; congestion results.

The methodology for this study begins by assembling the relevant facts about the brigade rear area. Section II defines which units may locate in the area, how they contribute to combat power generation, and their siting considerations. Section III describes the conditions that may cause overcrowding. Sections IV and V are the analysis. Section IV answers the research question

using Colonel Huba Wass de Czege's Combat Power Model as the criteria to explain how overcrowding degrades a brigade's combat power. Section V provides the means of relieving overcrowded conditions. Section VI includes the conclusions and implications of the study for the U.S. Army.

II. UNITS IN THE BRIGADE REAR AREA

There is no "typical" portrayal of which units locate in the brigade rear area. A review of three sources, summarized at Table I, indicates that the FSB is the only unit common to the brigade rear. Two of the sources agree that ten other units locate in the brigade rear; eleven units appear in only one source. The sources do not agree regarding even the divisional units habitually in direct support (DS) of the brigade.

Table I: Units in the Brigade Rear Area

	FM 71-3 ¹	FM 100-10 ²	BSA Lab ³
Habitually associated divisional units:			
Reserve Task Force	X		
Field Artillery Battalion (DS)	X		X
Combat Engineer Company (DS)		X	X
Military Police Platoon (DS)		X	X
Forward Support Battalion (DS) ⁴	X	X	X
Brigade Main Command Post	X		
Divisional assets tailored for the specific mission:			
Attack Helicopter Battalion	X	X	
Multiple Launch Rocket System Battery	X		
Air Defense Artillery (Vulcan/Scout) Battery		X	X
Signal Platoon		X	X
Target Acquisition Battery			X
Chemical Company/Platoon (Decontamination)		X	^
Chemical Platoon (Smoke)		X	
Combat Electronic Warfare and Intelligence Platoon/Sections		X	X
Corps assets tailored for the specific mission:			
Field Artillery Battalion (GS)	X	X ⁵	
Engineer Battalion (GS)	X	X	
Attack Helicopter Battalion		X	
Aviation Medical Evacuation Section		X	
Military Intelligence Company		X	
Signal Platoon		X	
Chemical Platoon (Smoke)		X	
Maintenance Section		X	

NOTES:

¹FM 71-3, Armored and Mechanized Infantry Brigade, 11 May 1988, p. 4-15.

²FM 100-10, Combat Service Support, 18 February 1988, p. 1-4.

³"BSA Lab," US Army Command and General Staff College, School of Advanced Military Studies, Academic Year 89/90, pp. 6-17.

⁴Located in the BSA.

⁵Shows a battery instead of a battalion.

Determination of which units actually position in the brigade rear depends primarily on the mission, the enemy, terrain, troops available, and time available - the METT-T factors. Both division and corps may place elements in DS or under the brigade's operational control (OPCON). But division and corps may also post units forward for reasons not directly associated with the brigade. For example, a corps covering force

forward of the brigade could mean that corps CS and CSS units occupy terrain in the brigade rear. The nature of the terrain or the distances between the corps headquarters and the covering force may make signal relay stations necessary for communications. Corps might push CSS elements forward to assist the covering force during a rearward passage of lines, depending on the troops and time available and the condition of the covering force as it withdraws. Likewise, division may post elements forward to accomplish missions not directly related to the brigade. Each command echelon impacts on units in the brigade rear area as resources are allocated and positioned based on the METT-T factors.

Combat Power Generation

Each unit in the brigade rear area contributes in some way to the generation of combat power at each tactical echelon. Using the elements of maneuver, firepower, and protection,¹³ Table II summarizes how brigade rear area units contribute to combat power generation.

Table II: Contribution of Units in the Brigade Rear Area to the Generation of Combat Power

	<u>Element of Combat Power</u>		
	<u>Maneuver</u>	<u>Firepower</u>	<u>Protection</u>
Field Artillery ¹	<ul style="list-style-type: none"> -Destroys enemy forces -Suppresses direct and indirect fires -Screens and isolates objectives -Attacks reinforcements -Covers feints, retrogrades and lateral moves -Seals off enemy counterattacks -Enhances economy-of-force actions -Disrupts enemy movement schedules -Isolates attacking echelons 	<ul style="list-style-type: none"> -Suppresses enemy direct and indirect fire weapons -Obscures vision of enemy direct fire gunners and observers -Slows enemy momentum to increase direct fire engagement time -Suppresses enemy air defenses 	<ul style="list-style-type: none"> -Supports the tactical combat force (TCF), bases, and base clusters with indirect fires
Engineers ²	<ul style="list-style-type: none"> -Mobility -Countermobility 	<ul style="list-style-type: none"> -Construction of firing positions -Obstacle emplacement 	<ul style="list-style-type: none"> -Survivability -Fortification -Sustainability
Combat Aviation ³	<ul style="list-style-type: none"> -Rapid concentration -Accelerates the operational tempo 	<ul style="list-style-type: none"> -Massed aerial fires -Directs ground fires 	<ul style="list-style-type: none"> -Security operations -Deception operations -Quick dispersion
Intelligence and Electronic Warfare ⁴	<ul style="list-style-type: none"> -Identifies enemy strengths/weaknesses -Terrain/weather intelligence -Suppresses/destroys enemy C3I -Enemy order of battle intelligence 		<ul style="list-style-type: none"> -Protects communications -Warning of enemy action (e.g., chemical, nuclear)
Air Defense Artillery ⁵	<-----Disrupts/destroys enemy air threat----->		
Signal ⁶	<-----Enables C3I----->		
Chemical	<ul style="list-style-type: none"> -Smoke operations 		<ul style="list-style-type: none"> -Chemical detection -Decontamination -Smoke operations
Combat Service Support ⁷	<ul style="list-style-type: none"> -Logistical readiness 	<ul style="list-style-type: none"> -Munitions supply -Firing systems maintenance and replacement 	<ul style="list-style-type: none"> -Health care -Supply of basic soldier needs

NOTES:

¹FM 6-20, Fire Support in Combined Arms Operations, 31 December 1984, p. 1-4.

²FM 5-100, Engineer Combat Operations, November 1988, p. 6.

³FM 1-100, Army Aviation in Combat Operations, February 1989, p. 1-2.

⁴FM 34-1, Intelligence and Electronic Warfare Operations, July 1987, p. 2-11; FM 34-80, Brigade and Battalion Intelligence and Electronic Warfare Operations, April 1986, p. 1-9.

⁵FM 44-1, US Army Air Defense Artillery Employment, 9 May 1983, p. 2-16.

⁶FM 11-92, Combat Communications Within the Corps, 1 November 1978, p. 1-3.

⁷FM 100-5, Operations, May 1986, pp. 12-13.

Table II shows that the relative importance of possible brigade rear area units is situationally dependent. The extent to which air defense artillery (ADA) contributes to combat power generation, for example, is directly related to the threat's offensive air capability. Electronic warfare (EW) units contribute only if the enemy uses that medium. In each instance, the METT-T factors determine which units are required and where they will locate. Therefore, while the number of units demanding space in the brigade rear area is potentially large, how many actually do so depends on their relative contribution to combat power generation.

Siting Considerations

Doctrine is rarely definitive as to units' space requirements. Estimates of the physical dimensions for the BSA alone range from twelve square kilometers¹⁴ to fifty square kilometers.¹⁵ Just as determination of which units locate in the brigade rear area is METT-T driven, so is the space which they require. This makes a quantitative approach to terrain management inappropriate.¹⁶ An alternative is to examine the units' respective siting considerations.

Table III summarizes the major siting considerations for units which may locate in the brigade rear area.

Table III: Terrain Management Considerations

<u>Type Unit</u>	<u>Positioned to:</u>	<u>Terrain/Location Implications</u>
Reserves ¹	-Permit rapid movement to points of probable employment	-Well forward in sector -Accessibility to roads
	-Secure unoccupied terrain within brigade sector	-Fields of fire -Mobility within position
	-Protect from observation and fires	-Concealment -Reverse slope
Field Artillery ²	-Maximize range	-In the offense, well forward -In the defense, deeper in sector
	-Protect from counterfires and ground attack	-Reverse slope -Concealment -Dispersion -Out of threat avenues of approach -Close to combat units
	-Enable frequent relocations	-Positions with good ingress/egress -Designation of alternate positions
	-Enable timely Class V resupply	-Accessibility to roads -Accessibility to Ammunition Transfer/Supply Points
Engineers	Note 3	
Military Police	Note 4	
Air Defense Artillery ³	-Employ weapons systems	-Clear observation and fields of fire
	-Protect from observation and ground attack	-Concealment -Dispersion
	-Enable frequent relocations	-Positions with good ingress/egress -Designation of alternate positions

NOTES:

¹FM 71-3, Armored and Mechanized Infantry Brigade, 11 May 1988, p. 3-3.²FM 6-20, Fire Support in Combined Arms Operations, 31 December 1984, p. 4-20; FM 6-20-1J, Field Artillery Battalion, 15 June 1984, p. 6-6 and p. 7-10; FM 6-20-2, Division Artillery, Field Artillery Brigade, and Field Artillery Section (Corps), 30 September 1983, p. 5-15.³Engineers will generally work throughout the brigade sector. However, an engineer battalion operating in the brigade sector will bring its trains which have terrain considerations as described for CSS units (see page 11).⁴Military Police will operate throughout the brigade sector. They usually locate a platoon command post in the BSA.⁵FM 44-16, Platoon Combat Operations - Chaparral, Vulcan, and Stinger, May 1987, p. C-6-7.

Table III (continued): Terrain Management Considerations

<u>Type Unit</u>	<u>Positioned to:</u>	<u>Terrain/Location Implications</u>
Combat Aviation ⁶	-Enhance tactical employment	-Accessibility to air corridors with minimum exposure
	-Land helicopters	-Open, flat terrain -Ample space -No conflict with movement of ground combat and CS units
	-Protect from observation and indirect fires	-Reverse slope
	-Enable frequent resupply of Classes III and V	Trains must be: ⁷ -Accessible to landing sites -Accessible to routes to Forward Arming and Refueling Points
Intelligence and Electronic Warfare ⁸ and Signal ⁹	-Employ systems	-Line of sight paths to target areas -Free of obstacles which obstruct transmissions -Free of active sources of radio interference -Firm/level ground surface
	-Enable frequent relocations	-Positions with good ingress/egress -Designation of alternate positions
	-Protect from observation and ground attack	-Concealment -Dispersion -Close to combat units
Chemical (Decontamination) ¹⁰	-Perform decontamination	-Near large water source -Accessibility to contaminated units -Space for staging area, decontamination operational area, reconstitution area
	-Protect from observation and ground attack	-Concealment -Close to combat units

NOTES:

⁶FM 1-111, Aviation Brigade, 12 August 1986, p. 6-7.⁷The considerations shown are only those peculiar to aviation battalion combat trains. Other considerations common to all trains (described on page 11) also apply to aviation units.⁸FM 34-80, Brigade and Battalion Intelligence and Electronic Warfare Operations, April 1986, p. 5-2.⁹FM 24-1, Combat Communications, 11 September 1985, p. 3-24.¹⁰FM 3-101, Chemical Staffs and Units, 22 April 1987, pp. 3-2 - 3-3.

Table III (continued): Terrain Management Considerations

<u>Type Unit</u>	<u>Positioned to:</u>	<u>Terrain/Location Implications</u>
Combat Service Support and battalion field trains ¹¹	-Maximize protection	-Concealment -Dispersion -Reverse slope -Out of range of enemy indirect fire weapons (130mm and below) -Out of threat avenue of approach
	-Perform support mission	-Accessibility to customers -Accessibility to supply routes -Trafficability of position -Built-up area when possible -Closer to rear of combat units during offensive operations; deeper in sector during defensive operations -No conflict with movement of combat and CS units

NOTES:

¹¹FM 63-2, Combat Service Support Operations - Division, 21 November 1983, p. 2-16 and p. 3-7; FM 63-2-2, Combat Service Support Operations: Armored, Mechanized, and Motorized Divisions, 29 October 1985, p. 2-21; FM 63-20, Forward Support Battalion, 17 May 1985, p. 2-10; Steve Brasier, "Heavy Battalion Trains," Infantry, 76 (July-August 1986), 15.

Table III furnishes several recurring themes concerning brigade rear area terrain management that form the restraints and constraints for siting rear area units. They are:

1. Most units in the brigade rear area depend on concealment for protection. Hence, the space which a unit requires is a function of both its size and the terrain it occupies. More open terrain offers less concealment, requiring more space to disperse. Failure to provide the necessary space infers the acceptance of risk regarding units' protection.

2. Protection requires dispersion between units in the brigade rear area. Dispersion provides smaller targets for attack by indirect fires. Also, detection

of dispersed cannon artillery units is more difficult, allowing guns to stay in position longer.¹⁷

3. Signatures significantly affect the brigade rear area. The visual and electronic signatures of artillery units suggest their positioning behind hill masses or trees.¹⁸ Thermal signatures force CSS units to disperse widely both within and between positions.¹⁹ Electronic signatures mean that field and air defense artillery, intelligence and electronic warfare (IEW) units, signal units, and command posts (CPs) will displace frequently to survive.²⁰ Alternate positions, unoccupied by other units and with good ingress, egress, and accessibility to trafficable routes, are required to facilitate rapid displacement.²¹ Signatures also necessitate dispersion in time as well as space. A position recently occupied by a high signature unit ought not be occupied again soon, no matter how desirable its terrain, since it is a likely target for attack.

4. Table III indicates that many units have inflexible terrain requirements. Aviation units obviously need open, relatively flat terrain. Combat service support units must have trafficable ground. Air defense artillery systems function best with elevation and clear fields of fire. Decontamination units demand access to water sources and adequate space for staging areas. Such inflexibility limits positioning options for some brigade rear area units.

5. The location of some units depends on their relation to other units or activities. Medical units typically locate near units that can provide protection while avoiding close proximity to priority targets (e.g., Ammunition Transfer Points (ATPs) and CPs).²² Units anticipating frequent relocation or resupply will locate close to roads. Many CS units, operating forward in the brigade rear, have limited defense capability and seek locations in close proximity to combat units.²³

The discussion of this section has described several variables and constants of brigade rear area terrain management. The residing units, the space they require, and their contribution to combat power generation vary with the factors of METT-T. Concealment and dispersion remain constant due to their role in protection. The effects of signatures and relatively inflexible siting requirements of some units are likewise invariable. Units demand brigade rear area space based on combinations of these dynamic and constant factors.

Terrain management revolves around the supply and demand for space. Having considered how brigade rear area units demand space, the next section adds the effects of terrain on space availability and describes how operational plans affect both the supply and demand sides of the equation.

III. CONDITIONS THAT MAY CAUSE OVERCROWDING

Overcrowding, by definition, is relational; it occurs when the space demanded exceeds what is available. The dynamics of supply and demand for space describe the conditions that may contribute to overcrowding in the brigade rear area. These conditions include the area's size and terrain configuration, similarities of units' siting requirements, and brigade and higher headquarters operational plans.

Brigade Rear Area Size and Terrain Configuration

A small brigade rear area situated on terrain poorly configured for the occupants means that the demand for space probably will exceed the supply. Obviously, the smaller the area, the more probable is overcrowding. Even if the only occupant is the FSB, its space requirements will not be met when the brigade rear area is whittled too far. The more likely problem is the amount of usable terrain in the brigade rear area. Steep slopes, few roads or little concealment may cause units to congest in relatively small portions of the allocated space. For example, the general ruggedness of some areas of the Federal Republic of Germany sometimes limits usable operating space.²⁴

Similarities of Siting Requirements

The second condition which may cause overcrowding is closely related to the first. Table III indicates that many brigade rear area units have similar site requirements. As an example, the brigade reserve task force, field artillery (FA) batteries, the FSB, and the aviation battalion all prefer reverse slope locations and concealment.²⁵ Of these, the latter three require trafficable roads for frequent resupply. Additionally, FA units want alternate positions with the same characteristics. If these units are in the brigade rear area simultaneously, then four sizable organizations are competing for the same type terrain. The terrain configuration of some brigade rear areas simply may not support all four. Units will then crowd into the space that meets their operational requirements or settle for less-than-desirable terrain, increasing risk to either their protection or to their operational capability.²⁶

Similar analysis applies to other potential brigade rear area units. Signal and IEW units compete for hill-tops with line of sight to target areas.²⁷ ADA units may desire the same positions.²⁸ Some brigade rear areas will support the terrain requirements of them all, but in others competition will result, with possible overcrowding. Again, supply and demand is the problem, but for specific types of terrain or locations rather than rear area space in general.

Operational Plans

Operational plans of brigades and higher headquarters form the third condition which may cause overcrowding. The various brigade tactical operations require different combat, CS, and CSS units. Within the larger operational schemes of divisions and corps, brigades may defend as part of offensive operations or attack as part of defensive operations. A brigade may be the main or supporting effort for its division or corps, or both, in offensive and defensive operations. The brigade, division, and corps may plan counterattacks that traverse the brigade rear area. To a significant degree, each of these combinations will dictate both the units locating in the brigade rear area and the space available in that area.

Offensive operations, almost by definition, deepen unit sectors if successful. Most CS units locate close to the forward edge of the battle area (FEBA) initially and displace forward frequently to keep target areas within range.²⁹ Combat service support units locate as far forward in the brigade rear as possible, prepared to move in support of the combat battalions.³⁰ Rear area overcrowding is simply unlikely during execution of successful offensive operations.

Overcrowding is possible during preparation for offensive operations, particularly if the brigade is the main effort or part of one. The main effort is weighted

by FA, ADA, engineers, aviation, IEW, and signal resources from division and possibly corps levels.³¹ These CS units bring more CSS units into the area of operations since the capability of the FSB to support them is limited.³² The sufficiency of usable terrain during this preparatory time depends on the size and terrain configuration of the brigade sector, the sequencing of the additional units, and the space and relative locations which they demand.

Defensive operations, especially those fought through the depth of the brigade sector, complicate terrain management in the brigade rear area. Units may disperse throughout the depth of the brigade sector at the start of defensive operations, but a battle fought in depth, whether planned or not, eventually causes some units to fall back into the brigade rear area.

Positioning of resources in preparation for defensive operations may contribute to overcrowding before the battle begins. The brigade reserve task force and CS units are more likely to demand space in the rear. Subsequent, alternate, and supplementary positions for signature producing systems further require terrain deeper in the brigade sector.³³ A planned defense in depth may mean a smaller brigade rear than a forward defense.³⁴ Designation of a brigade as the main effort brings additional units into its sector as in offensive operations. These combinations mean that a defense in depth can result in more units on less terrain in the

brigade rear.

Counterattack plans can further congest the brigade rear area during defensive operations for two reasons.³⁵ First, reserve formations may demand space in the brigade rear. Secondly, units should not locate in the reserves' axis of advance;³⁶ counterattack plans through the rear area "use" terrain - almost as if it is occupied.

The amount of space which counterattacks and reserve formations require is a function of several variables. A brigade's reserves sometimes locate in the brigade rear area. Division and corps reserves, though usually not located in the brigade rear, may require considerable amounts of space for their planned axes of advance. The size of the reserve depends on the commander's concept of operation.³⁷ Branches to counterattack plans can result in multiple axes of advance,³⁸ consuming more space in the process. Other factors of METT-T influence the size of the reserves, their initial positions, and their axes of advance.³⁹

The impact of reserve formations and counterattack plans on terrain management in the brigade rear area is summarized in two rules of thumb. One, the larger the reserves, the more likely that they will contribute to overcrowding, as illustrated in Figures 1 and 2. Figure 1 shows a brigade reserve task force employed in a counterattack. Figure 2 shows a division reserve brigade counterattacking through the brigade rear while the

brigade reserve task force blocks an enemy penetration.
Less space is available to brigade rear area units in
Figure 2 because of the division reserves' axis of
advance.

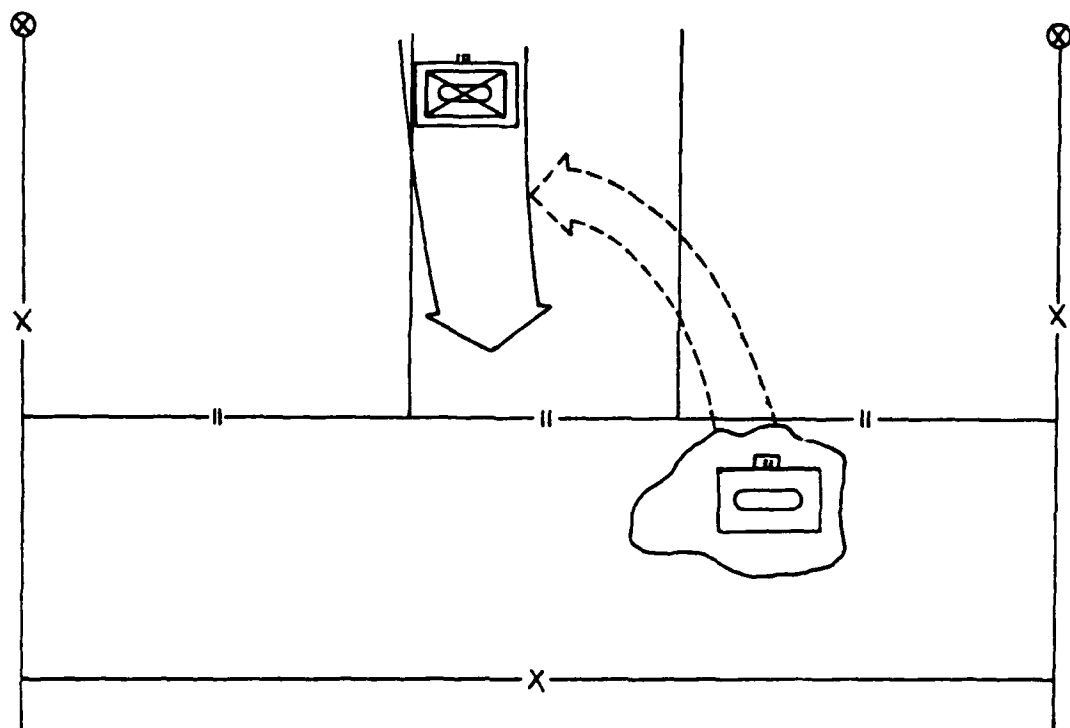


Figure 1: Brigade Counterattack in Sector

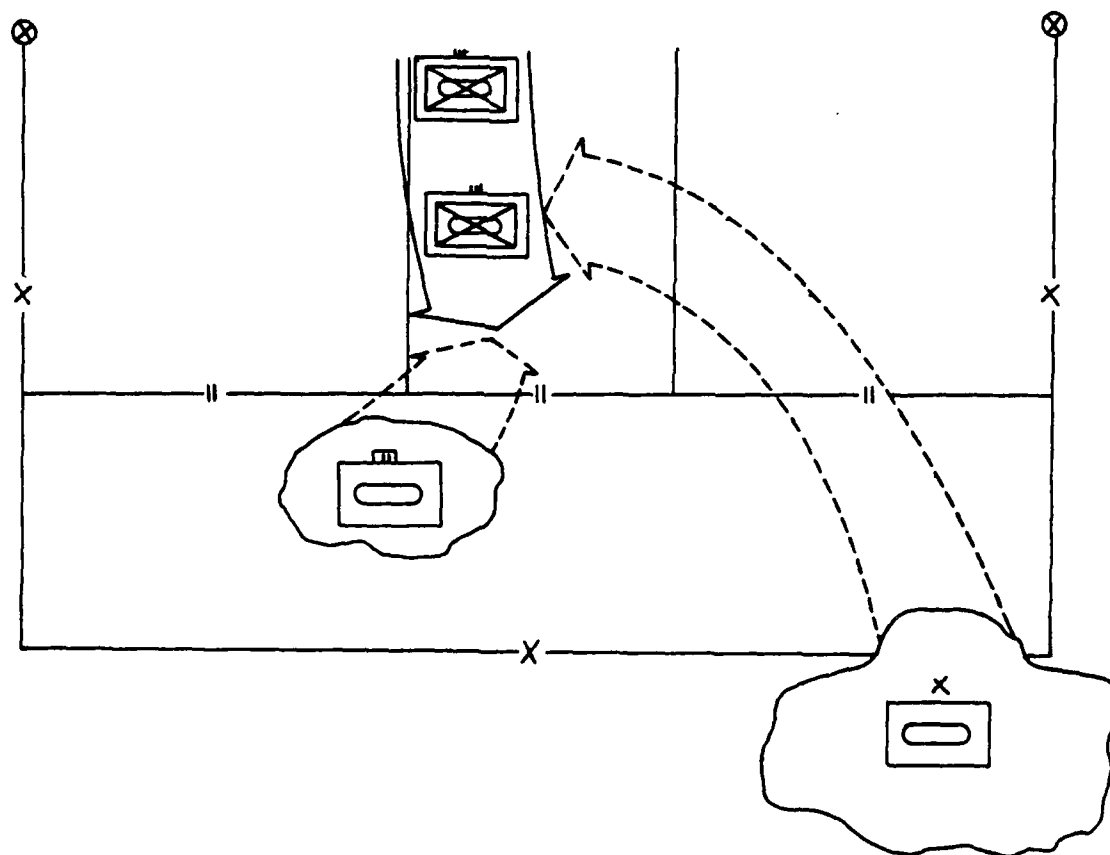


Figure 2: Division Counterattack
Through the Brigade Sector

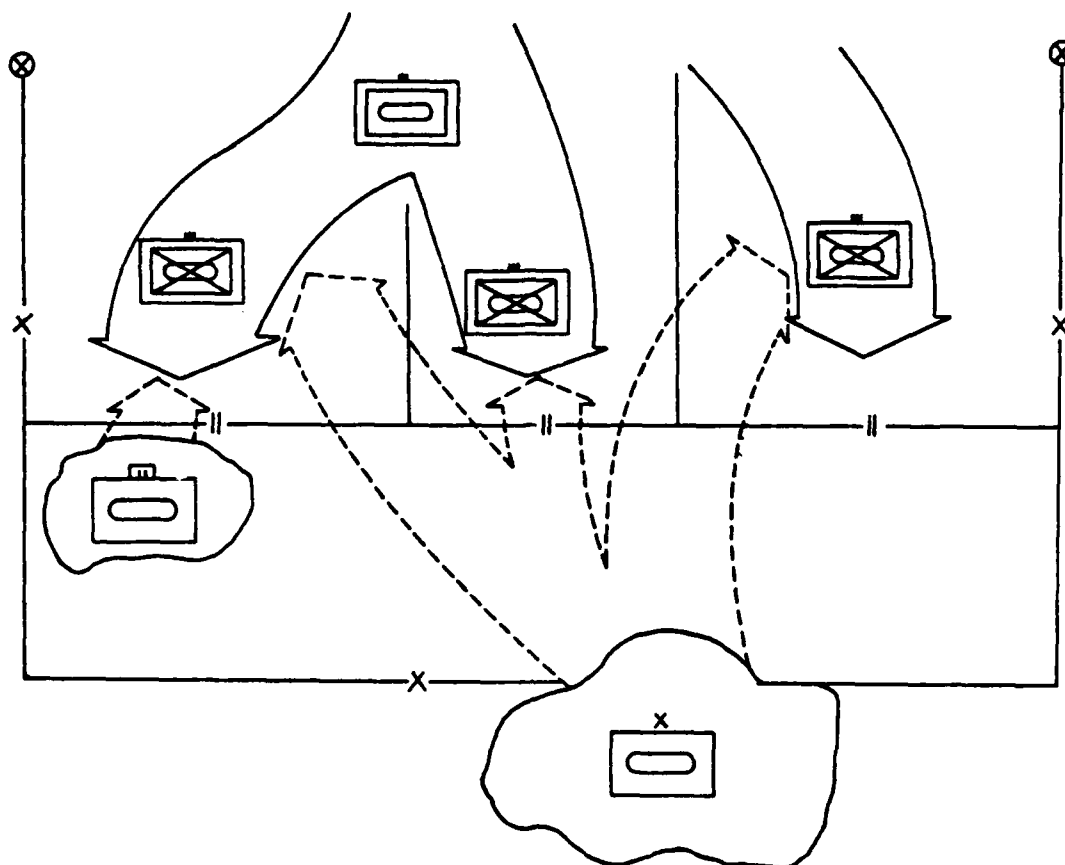


Figure 3: Division Counterattack Plans
With Three Axes

The second rule of thumb is that the more flexible counterattack plans become, the greater the probability that they will contribute to overcrowding. Figure 3 adds flexibility to the counterattack plans of Figure 2, showing three axes of advance for the divisional reserve brigade. This flexibility is not without cost, however. The brigade rear area has become largely unavailable to support units because of the contingency counterattack plans. This example illustrates how higher headquarters' plans can contribute significantly to overcrowding in the brigade rear area.

A delay operation conducted within the framework of the defense exacerbates all the potential problems of overcrowding. Both CS units and maneuver units move back, congesting the brigade rear. A delay requires maximum use of obstacles throughout the brigade sector,⁴⁰ further constraining available space.

Other tactical operations which a brigade can conduct may also contribute to overcrowding in its rear area. A river crossing brings engineer bridging units forward and requires equipment staging areas removed from the actual crossing sites.⁴¹ Staging areas and service support assets of the engineer units may need space in the brigade rear. A passage of lines requires dedicated routes through the depth of the brigade sector,⁴² making route congestion a potential problem.

Resources are allocated and boundaries and axes of advance are drawn based on operational plans. Units - the resources - may have similar siting requirements, causing them to congest on the available terrain. Boundaries define the size of the brigade rear area. Axes may limit the space available to rear area occupants. Only the terrain configuration is not a function of operational plans. Thus, except in the worst of terrain, overcrowding is driven primarily by the operational plans of brigades and their higher headquarters.

Brigade rear area terrain management is more than a process of balancing aggregate space demands with

supply. Sufficient space may exist, but the terrain can be wrong for the occupants' operational needs. Similarly, units may compete for the same terrain even when space is seemingly adequate. Finally, operational plans introduce a host of variables that can impact on both the space demanded and the space available. It is the interaction of rear area units, operational plans, and the terrain that determines the adequacy of available space.

This discussion would be largely academic except that rear area overcrowding affects a brigade's very reason for being - its ability to generate combat power. The next section explains why this is so.

IV. THE RELATIONSHIP BETWEEN OVERCROWDING IN THE BRIGADE REAR AREA AND COMBAT POWER GENERATION

The process of combat power generation is described by Colonel Huba Wass de Czege in a manuscript entitled, "Understanding and Developing Combat Power."⁴³ His model features four variables that combine to generate combat power: firepower, maneuver, protection, and leadership effects. He describes a process by which leaders manipulate the available firepower, maneuver, and protection effects to produce the optimum warfighting potential in a given situation. Wass de Czege details the model by adding the components of each variable. The Combat Power Model provides the criteria

against which the effects of overcrowding can be explained and gauged.

Table IV: The Combat Power Model¹

COMBAT POWER IS A FUNCTION OF:

1. FIREPOWER EFFECT: (which is a function of)

VOLUME OF FIRE: (which is a function of)

Number of delivery means
Supply capability²
Rate of fire of weapons systems²

LETHALITY OF MUNITIONS:

Design characteristics
Explosive energy

ACCURACY OF FIRES:

Weapon and munition design characteristics
Crew proficiency
Terrain effects
Visibility

TARGET ACQUISITION:

Intelligence and intelligence analysis
Location and functioning of observers and sensors
Transmission of target data

FLEXIBILITY OF EMPLOYMENT:

Weapons ranges
Mobility²
Signature effects²
Fire control systems
Tactical employment doctrine

2. MANEUVER EFFECT:

UNIT MOBILITY:

Physical fitness and health of individuals
Unit teamwork and esprit
Unit equipment capabilities²
Unit equipment maintenance²
Unit mobility skills

TACTICAL ANALYSIS:

Intelligence and knowledge of enemy tactics
Understanding of terrain effects
Understanding of own unit capabilities

MANAGEMENT OF RESOURCES:

Equipment utilization
Supplies utilization
Personnel utilization
Time utilization
Utilization of energies of subordinates

COMMAND, CONTROL AND COMMUNICATIONS:

Span of control²
Standard operating procedures and doctrine
Staff efficiency
Communications efficiency²

Table IV (continued): The Combat Power Model¹

3. PROTECTION EFFECT:

CONCEALMENT:

Camouflage²
Stealth
Equipment design
Counter enemy intelligence acquisition means

EXPOSURE LIMITATION:

Minimize potential target size²
Minimize potential target exposure time
Complicate potential target tracking

DAMAGE LIMITATION:

Individual protective equipment design and use
Use of natural cover²
Use of artificial cover
Combat vehicle design
Medical treatment and evacuation system²
Combat equipment cannibalization and repair²
Alternate command and control arrangements
Providing personnel and materiel replacements²
Miscellaneous efforts to maintain continued combat effectiveness of units

NOTES:

¹Colonel Huba Wass de Czege, "Understanding and Developing Combat Power," in ANSP Course 2 Tactical Dynamics (Fort Leavenworth, Kansas: Command and General Staff College, School of Advanced Military Studies, Academic Year 1989/90), pp. 17-18. The fourth element of combat power, leadership effects, is not shown here.

²Affected by brigade rear area overcrowding.

Firepower Effects

Firepower effects are a function of five different variables;⁴⁴ overcrowding in the brigade rear area affects two. First is the volume of fire. Combat service support units forced to locate on untrafficable ground or away from supply routes suffer a reduction in ammunition supply capability, affecting units throughout the brigade sector. Overcrowding could also impede resupply to artillery units operating in the rear area by making them harder to find by ammunition convoys.⁴⁵ Artillery units positioned on less-than-desirable terrain, a possible result of overcrowding, are more

susceptible to counterbattery fires, thereby reducing their rate of fire. By reducing both supply capability and rate of fire, overcrowding degrades volume of fire.

The second firepower effects variable affected by overcrowding is flexibility of employment of weapons systems.⁴⁶ Constrained resupply operations will limit the variety of ammunition available to both combat and CS units. Weapon systems are less mobile because roads are congested. Weapons signature effects are harder to reduce when the right terrain is unavailable, causing more frequent relocations and degrading flexibility of employment.

The degree to which firepower effects are impacted by an overcrowded brigade rear area depends primarily on the extent to which ammunition resupply is hampered and the severity of constraints on artillery units. In turn, ammunition resupply to combat and CS units is a function of ammunition availability, equipment availability, trafficable ground at the ATP and battalion field trains, and proximity to uncongested supply routes; overcrowding affects the last two. Next, the ability of artillery to move, shoot, and avoid counterfires is a function of several variables. Among them are availability and accessibility of good firing positions, uncongested routes to move between them, and delivery of ammunition. Overcrowding affects the first two for artillery units located in the brigade rear. The last, delivery of ammunition, congestion degrades

regardless of the units' locations. Hence, because of the impact on ammunition resupply and artillery capabilities, overcrowding in the brigade rear area will subtract from the brigade's firepower effects.

Maneuver Effects

The maneuver effects variable of the combat power model is a function of four component variables,⁴⁷ two of which are affected by overcrowding. Congested roads and terrain degrade mobility for units operating in an overcrowded rear area. Units forward in the brigade sector also may suffer loss of mobility because of constrained fuel resupply, a possible outcome of congestion. Similarly, overcrowding may prolong the time necessary for DS and field train maintenance since they rely heavily on repair parts resupply. Mobility, then, is dampened for units throughout the brigade sector by overcrowding in the rear.

The second component of maneuver effects influenced by overcrowding is command, control, communications, and intelligence (C3I).⁴⁸ Signal units, IEW units, and CPs, critical to this function, will present larger signatures if poorly located, making them more vulnerable. Also, the brigade commander will devote attention to problems resulting from rear area congestion when they become troublesome enough. That turns time, effort, and resources away from the brigade's operational mission.

In subtle but important ways, overcrowding strikes a brigade's maneuver effects by degrading C3I.

Maneuver effects, then, are affected because CSS operations throughout the brigade sector are more difficult and C3I is retarded. How much degradation occurs due to constrained CSS operations depends on numerous variables: the maintenance and fuel status of supported combat and CS units, proximity of CSS units to trafficable routes, availability of repair parts and maintenance support teams (MSTs), and others. The magnitude of the impact on C3I is a function of poor positioning of signal units, IEW units, and CPs, and the diversion of the commander's attention. As with firepower effects, overcrowding degrades the brigade's maneuver effects in potentially significant ways.

Protection Effects

Overcrowding's most serious impact on combat power generation occurs through degradation to protection. Protection is first a function of concealment, which is largely a function of camouflage.⁴³ The visual and electronic signatures of artillery units, the electronic signatures of signal and IEW units, and the thermal signatures of CSS units are natural by-products of those units' operations. Signature reduction through various techniques is possible, but overcrowding complicates the task. Camouflaging routes of ingress and egress, highly

visible signatures for many rear area units, likewise becomes more difficult when units are compressed. Finally, locations where camouflage is reasonably achievable can simply run out. In short, it may be "hard to find a tree to get behind."⁵⁰

The second variable of protection effects is exposure limitation. This term "includes all of those actions taken to make personnel, equipment and units a more difficult target once they have been detected."⁵¹ These actions entail relocating quickly and the effective use of terrain (e.g., reverse slopes and dispersion). Previous discussion has revealed the ways in which overcrowding makes these exposure limitation actions difficult.

Protection effects have as a third variable damage limitation.⁵² Overcrowding in the brigade rear area may make damage limitation hard for both combat units located forward in sector and the CS and CSS units in the rear area. The brigade's combat units are affected by degradation to the medical treatment and evacuation system and the personnel and materiel replacement system. Damage limitation is more difficult for units in the brigade rear area when the requirements for natural cover exceed what is available.

In summary, CSS doctrine consistently teaches that protection of its units depends mostly on passive measures, specifically concealment and dispersion.⁵³ Though less emphatically stated, this is also true of

many CS units as well. By making these measures more difficult, overcrowding can significantly reduce the protection of brigade rear area units. The protection effects of units operating forward of the rear area are affected by degrading the damage limitation capability of the brigade overall.

Overcrowding in the rear area affects the brigade's ability to generate combat power because it degrades firepower, maneuver, and protection. Numerous variables determine the significance of overcrowding's effects on any given operation. Field Manual 90-14 states, "The AirLand Battle cannot be won solely by fighting the rear battle; but it could well be lost in the rear."⁵⁴ Overcrowding could be problematic enough to make this statement true not only by destruction or neutralization of rear area units, but by substantially degrading the brigade's overall ability to generate combat power. Obviously, solutions are needed.

V. RELIEVING OVERCROWDED CONDITIONS

Alternative means for relieving overcrowded conditions in the brigade rear area are to enlarge the area, change operational or logistical support plans, or relocate some units out of the sector. This section examines each option.

Enlarging the Brigade Rear Area

Possibly the simplest way to relieve overcrowding is to enlarge the brigade rear area. Boundaries are not etched in stone; coordination with higher headquarters when congestion is a problem may provide the solution. The added terrain's configuration and relative location will determine the viability of this alternative. Terrain configured unsuitably for overcrowded units or located far afield from where the units can operate effectively will not solve the problem. Furthermore, making the area larger is not without risks since it enlarges the brigade's area of responsibility and can impinge on operational plans of higher or adjacent headquarters. In short, enlarging the brigade rear area might be the simplest way to relieve overcrowded conditions, but it is not the best under all circumstances.

Changing Plans

Section III established that operational plans can cause overcrowding. It follows that changing operational plans is a way to reduce overcrowding in the brigade rear area. Overcrowding in the rear area rarely, if ever, prompts major changes in a brigade's plans (e.g., offense to defense, main to supporting attack), but minor alterations may help decongest a crowded rear. For example, narrowing a reserve's axis of advance may remove enough terrain restraints to solve the problem.

Using roads other than supply routes for movements of formations minimizes congestion in the rear. Of course, the feasibility of even small changes is a function of the METT-T factors, but when possible their adoption may significantly lessen brigade rear area overcrowding.

Changing logistical support plans may help deconflict routes within sector. Designated supply routes could be available for unit movements through the area for short time windows by using serial resupply or stockpiling supplies forward. Such measures require thorough analysis to compare the risks to logistical support with the benefit of reduced overcrowding.²⁵ Above all, good planning is imperative.

Perhaps the best way that both operational and logistical support plans can relieve overcrowding is through synchronization of the combat, CS and CSS activities that occur in the brigade area. Synchronization, according to Field Manual 100-5, "is the arrangement of battlefield activities in time, space and purpose to produce maximum relative combat power at the decisive point."²⁶ Most important, synchronizing brigade rear activities requires consideration of when and where the decisive point will occur. This means that brigade rear activities are closely linked to the commander's operational intent.

Synchronizing brigade rear activities in time means locating units in the area only when they are operationally required. Their presence either sooner or later

than they can contribute to a force's relative combat power results in occupation of space that might be better utilized. Arranging the brigade rear activities in space entails careful allocation of available terrain to insure its most efficient and effective use. "Goose eggs" which economically designate unit positions amenable to their terrain and location requirements are an important to synchronize brigade rear activities in space.

Eliminating duplicity of rear area activities provides synchronization in terms of purpose. Determining the right amounts of artillery, signal, maintenance, supply, and other CS and CSS resources to apply in a given situation is key to this aspect of synchronizing brigade rear activities. Having too little impairs generation of relative combat power, but too much may cause overcrowding that also degrades combat power.

Synchronization of brigade rear area activities with the operational plan can significantly reduce overcrowding problems while concurrently generating maximum relative combat power. Conversely, failure to synchronize them may contribute to overcrowding and degrade combat power in the process.

Relocating Brigade Rear Area Units

Relocating units out of the brigade rear area without some compensating action is the last resort to

relieving overcrowded conditions. Section II established how brigade rear area units contribute to combat power generation. Relocation of activities that have been properly synchronized implies a degradation in the ability of the brigade or its higher headquarters to generate combat power. Therefore, the decision to relocate units out of the brigade sector must weigh the risks to relative combat power generation against the benefits of a less crowded brigade rear area.

The basis for determining which units to relocate is their relative contribution to combat power generation for the operation at hand. The factors of METT-T provide the criteria for this determination. The mission of the brigade and its higher headquarters may make intelligence collection more important than obstacle emplacement, suggesting a redundancy in C3I capability and relocation of engineer units. A chemical company in the brigade rear assumes greater relative importance than other units if the threat of chemical attack is high. Clearly, this sort of analysis is situationally dependent and very difficult; again, it is a mechanism of last resort.

The decision process is continuous; requirements for rear area units change with the situation. Operational planners must consider the time required to bring a rear area unit back into sector once it has relocated; demanding it the moment it is needed is too late. The equipment of many rear area units and the congestion

that forced their relocation can combine to further lengthen the leadtime for their recall.

Finally, the command relationships of units in the brigade rear area are especially critical if some of them must relocate out of sector. Some of the units, particularly IEW, signal, and CSS supporting corps CS units in sector, may report operationally to division or corps level. Relocating them may require divisional or corps directive. Additionally, a brigade commander may hesitate to relocate attached or OPCON units out of sector because he has no means of controlling them; relocating them may equal losing the resources.

To restate, moving units out of the brigade rear area to relieve overcrowding is a measure of last resort. The risks to combat power generation, the complexities of the synchronization process, and the complication of command relationships combine to discourage this option.

Overcrowding in the brigade rear area is not an insurmountable problem. Synchronization of rear area activities with operational plans may avoid the situation altogether even under conditions susceptible to it. Enlarging the area will solve overcrowding problems if the added terrain is suitable. As a last resort, units may relocate out of the brigade sector, a decision demanding thorough consideration of the associated risks and benefits.

VI. CONCLUSION AND IMPLICATIONS

Overcrowding in the brigade rear area occurs under conditions described best by the factors of METT-T. However, METT-T analysis falls short if applied only to the brigade level; divisions and corps are more likely to cause overcrowding than the brigade in isolation. As the higher echelons position reserves, plan counter-attacks, weight main efforts, and push combat, CS, and CSS resources forward either to support the brigade or to accomplish tasks independent of brigade missions, they can contribute significantly to congestion.

The problem of overcrowding in the brigade rear area is important because it affects the ability of a brigade, and thus a division and corps to generate combat power. Specifically, overcrowding degrades the firepower, maneuver, and protection effects variables of the Combat Power Model. Of these, protection effects are most seriously impacted not only for units located in the rear area but for the brigade overall.

A final conclusion is that preventing or reducing overcrowding is achievable within existing resources. Synchronization of rear area activities, redrawing boundaries, and even relocating units are actions which brigade staffs perform routinely. Heightened awareness of the potential degradation to combat power generation may prevent overcrowding in many instances.

The implications of this study for the U.S. Army flow from the conclusions. First, and most important, Field Manual 71-3 should address brigade rear area terrain management. This would increase attention to the subject in the field. The manual should outline the potential causes and possible solutions to terrain management problems and frame the associated risks and benefits to combat power generation. It should clearly assign terrain management responsibilities for the rear area outside the BSA. Finally, it should offer considerations for positioning and controlling rear area units. Worth noting is that the division and corps counterparts to Field Manual 71-3, Field Manuals 71-100 and 100-15, include sections on rear area terrain management that address many of these issues for their respective echelons.

A second implication is that divisions and corps must actively participate in brigade rear area terrain management. This means that division and corps headquarters must systematically monitor how their allocation of resources and operational plans affect space availability in subordinate brigade sectors. Techniques that would accomplish this include periodic location reporting of division and corps units in brigades' rear areas, aerial inspections, and regular dialogue with the brigade rear area terrain manager. Division and corps resources and plans can impact on the brigade rear area to such an extent that the involvement of the higher

headquarters is essential.

A recommendation supporting these implications concerns terrain management responsibility. As previously stated, Field Manual 71-3 vaguely assigns this task to the brigade S3. A better alternative may be the brigade executive officer (XO). He understands the tactical situation. He is already responsible for directing and coordinating "CS in consonance of the commander's plan" and ensuring "continuous CSS." Moreover, "the XO is involved in rear operations because of his duties of coordinating the staffs of the main and rear CPs."⁷ In short, the XO's duties dovetail with terrain management activities while the S3's focus on the current battle makes questionable his capability to manage rear area terrain.

Overcrowding in its rear area certainly will not be perceived as the brigade's most serious problem when the close battle is joined. Nonetheless, its occurrence erodes the brigade's ability to generate combat power, and the friction of war suggests that it will be manifest at the worst possible time. Overcrowding is a problem usually preventable or solvable through good techniques and practices. Like many problems, recognition of its presence is a large part of its solution. Essentially, terrain management in the brigade rear area demands clear assignment of responsibilities and cooperation between brigades, divisions, and corps.

GLOSSARY

ADA	air defense artillery
ATP	ammunition transfer point
BSA	brigade support area
COSCOM	corps support command
CP	command post
CS	combat support
CSS	combat service support
C3I	command, control, communications, and intelligence
DISCOM	division support command
EW	electronic warfare
FA	field artillery
FEBA	forward edge of the battle area
FSB	forward support battalion
IEW	intelligence and electronic warfare
METT-T	mission, enemy, terrain, troops available, and time available
MP	military police
MST	maintenance support team
OPCON	operational control
RAOC	rear area operations center
SOP	standard operating procedure
S3	operations officer
TCF	tactical combat force
XO	executive officer

ENDNOTES

¹Roland G. Ruppenthal, Logistical Support to the Armies, Volume I: May 1941 - September 1944 (Washington, D.C.: U.S. Government Printing Office, 1953), pp. 430-432

²Martin Van Creveld, Supplying War: Logistics From Wallenstein to Patton (Cambridge: Cambridge University Press, 1982), p. 209.

³Ruppenthal, p. 431.

⁴U.S. Department of the Army, Operations, Field Manual 100-5 (Washington, D.C.: U.S. Government Printing Office, May 1986), pp. 20-21.

⁵U.S. Army Center for Army Lessons Learned, "Focus on Rear Operations," Center for Army Lessons Learned Bulletin 2-86 (Fort Leavenworth, KS: U.S. Army Combined Arms Training Activity, November 1986), p. 10.

⁶U.S. Department of the Army, Rear Battle, Field Manual 90-14 (Washington, D.C.: U.S. Government Printing Office, June 1985), pp. 3-17 - 3-19.

⁷U.S. Department of the Army, Division Operations (Approved Final Draft), Field Manual 71-100 (Washington, D.C.: U.S. Government Printing Office, 15 November 1988), p. 1-15; U.S. Department of the Army, Corps Operations, Field Manual 100-15 (Washington, D.C.: U.S. Government Printing Office, September 1989), pp. D-0 - D-1.

⁸U.S. Department of the Army, Armored and Mechanized Infantry Brigade, Field Manual 71-3 (Washington, D.C.: U.S. Government Printing Office, 11 May 1988), pp. 5-21 - 5-22.

⁹John R. Landry and Bloomer D. Sullivan, "Forward Support Battalion," Military Review, LXVII (January 1987), 26-27. This article illustrates how these definitions are misunderstood. It states, "The BSA is defined as the area to the rear of the battalion combat trains and forward of the brigade rear boundary. The FSB commander has positioning authority and operational control (OPCON) for rear area defensive purposes, over all units located there." When the article was written, Landry was the Director of the Center for Army Tactics and Sullivan had commanded an FSB. This important distinction is seldom clarified elsewhere. In 1989 the School of Advanced Military Studies conducted an exercise entitled "BSA Lab" even though the scenario included more than BSA units, and they were distributed throughout the brigade rear area. ("BSA Lab," U.S. Army

Command and General Staff College, School of Advanced Military Studies, Academic Year 89/90.)

¹⁰U.S. Department of the Army, Operational Terms and Symbols, Field Manual 101-5-1 (Washington, D.C.: U.S. Government Printing Office, October 1985), p. 1-59.

¹¹Field Manual 71-3 is not as clear regarding who is responsible for positioning units in the brigade rear as it should be. Twice it states that the FSB commander has OPCON over all units in the BSA for positioning (p. 2-7 and p. 5-22). The closest it comes with respect to the rest of the brigade rear is, "The brigade S3 includes detailed planning for the entire rear area as part of operational planning for offensive and defensive missions." (p. 5-21) Alternatively, both Field Manual 71-100 (p. 1-15) and Field Manual 100-15 (p. D-0) specify that the G3 is the overall terrain manager at division and corps levels, respectively.

¹²Field Manual 101-5-1, p. 1-12.

¹³Field Manual 100-5, p. 11.

¹⁴U.S. Army Command and General Staff College, G4 Battle Book, Student Text 101-6 (Fort Leavenworth, KS: U.S. Government Printing Office, 1 June 1989), p. D-1.

¹⁵Christopher R. Peparone, "Overcoming Threats to the Brigade Support Area," Army Logistician (May-June 1988), 32.

¹⁶While this approach is inappropriate, it is possible. For example, Field Manual 63-2-2, Combat Service Support Operations: Armored, Mechanized, and Motorized Divisions (29 October 1985) indicates that CSS units should locate at least one to two kilometers apart and that vehicles within unit positions should be 100 to 200 meters apart (p. 3-5). This information permits calculation of upper and lower bounds for how much space the BSA requires. However, expanding this method to the brigade rear area is futile for two reasons. First, CSS doctrine singularly provides this information, and its applicability to the combat and CS units in the brigade rear is doubtful. Secondly, CSS doctrine provides no indication, other than that noted, of the amount of space CSS units require. The doctrinal authors apparently prefer the METT-T approach.

Nonetheless, the more prescriptive technique has some merit. Planners and operators currently have no guide, other than personal knowledge and unit standard operating procedures, of how much space units occupy, be they combat, CS, or CSS. This may contribute indirectly to overcrowding in rear areas.

¹⁷U.S. Department of the Army, Field Artillery Battalion, Field Manual 6-20-1J (Washington, D.C.: U.S. Government Printing Office, 15 June 1984), p. 6-6.

¹⁸Field Manual 6-20-1J, p. 6-6.

¹⁹U.S. Department of the Army, Combat Service Support Operations: Armored, Mechanized, and Motorized Divisions, Field Manual 63-2-2 (Washington, D.C.: U.S. Government Printing Office, 29 October 1985), p. 3-5.

²⁰U.S. Department of the Army, Combat Communications Within the Corps, Field Manual 11-92 (Washington, D.C.: U.S. Government Printing Office, 1 November 1978), p. 2-6.

²¹U.S. Department of the Army, Brigade and Battalion Intelligence and Electronic Warfare Operations, Field Manual 34-80 (Washington, D.C.: U.S. Government Printing Office, April 1986), p. 5-2.

²²Field Manual 71-100, p. 1-15.

²³Field Manual 6-20-1J, p. 6-6.

²⁴Interview with Major Steve Barth, U.S. Army Command and General Staff College, Department of Sustainment and Resourcing Operations, Fort Leavenworth, Kansas, 8 September 1989.

²⁵While the aviation battalion requires open terrain for landing zones, its trains require concealment just as maneuver battalion trains. See U.S. Department of the Army, Aviation Brigade, Field Manual 1-111 (Washington, D.C.: U.S. Government Printing Office, 12 August 1986), p. 6-7.

²⁶U.S. Department of the Army, Combat Service Support Operations - Division, Field Manual 63-2 (Washington, D.C.: U.S. Government Printing Office, 21 November 1983), p. 2-3. This source describes the concept of risk-benefit analysis, using as an example the positioning of CSS units.

²⁷Field Manual 34-80, p. 5-2.

²⁸U.S. Department of the Army, U.S. Army Air Defense Artillery Employment, Field Manual 44-1 (Washington, D.C.: U.S. Government Printing Office, 9 May 1983), p. 4-17.

²⁹U.S. Department of the Army, Fire Support at Corps and Division (Coordinating Draft), Field Manual 6-20-30 (Fort Sill, OK: U.S. Government Printing Office, 1 March 1988), p. 4-5.

³⁰U.S. Department of the Army, Forward Support Battalion, Field Manual 63-20 (Washington, D.C.: U.S. Government Printing Office, 17 May 1985), p. 2-2.

³¹Field Manual 71-3, pp. 3-4 - 3-7.

³²Field Manual 63-20, p. 1-6.

³³U.S. Department of the Army, Fire Support in Combined Arms Operations, Field Manual 6-20 (Washington, D.C.: U.S. Government Printing Office, 31 December 1984), p. 4-20.

³⁴Field Manual 71-3, p. 4-5.

³⁵"Counterattack" is used in this context to represent all the purposes for which the reserves may be employed. Field Manual 71-3 provides several purposes of the brigade reserves other than counterattacks, including spoiling attacks, raids, blocking penetrations, reacting to rear and flank threats, and relieving depleted units (p. 4-8). Regardless of the reserves' purpose, they have an origin and a destination, and in most cases plans will show an axis of advance between the two. The focus of this discussion is on the reserves' location and its axis of advance rather than the specific purpose of its employment.

³⁶Field Manual 100-5, p. 20.

³⁷Field Manual 100-5, p. 148.

³⁸Field Manual 100-5, p. 133.

³⁹Field Manual 71-3, p. 4-9.

⁴⁰Field Manual 71-3, p. 5-14.

⁴¹U.S. Department of the Army, River Crossing Operations, Field Manual 90-13 (Washington, D.C.: U.S. Government Printing Office, 1 November 1978), p. 3-29.

⁴²Field Manual 71-3, p. 5-4.

⁴³Huba Wass de Czege, "Understanding and Developing Combat Power," in AMSP Course 2 Tactical Dynamics (Fort Leavenworth, KS: Command and General Staff College, School of Advanced Military Studies Course Readings, Academic Year 1989/90), pp. 1-54.

⁴⁴Wass de Czege, pp. 23-25.

⁴⁵Field Manual 6-20-1J, p. 7-10.

⁴⁶Wass de Czege, p. 25.

⁴⁷Wass de Czege, pp. 26-29.

⁴⁸Wass de Czege, p. 29.

⁴⁹Wass de Czege, pp. 30-31.

⁵⁰Brigadier General Paul J. Vanderploog, presentation to the School of Advanced Military Studies, 27 October 1989.

⁵¹Wass de Czege, p. 31.

⁵²Wass de Czege, pp. 32-34.

⁵³Field Manual 63-2, p. 2-16; Thomas A. Hooper, "The Principles of War and Rear Area Protection: Have We Achieved Economy of Force?" (unpublished monograph, U.S. Army Command and General Staff College, School of Advanced Military Studies, 17 January 1988), p. 20; Carmine A. Egidio and Michael C. Hagerman, "Rear Operations in the Brigade Support Area," Army Logistician (November-December 1987), 34.

⁵⁴Field Manual 90-14, p. i.

⁵⁵Field Manual 63-2, p. 2-3.

⁵⁶Field Manual 100-5, p. 17.

⁵⁷Field Manual 71-3, p. 2-6.

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